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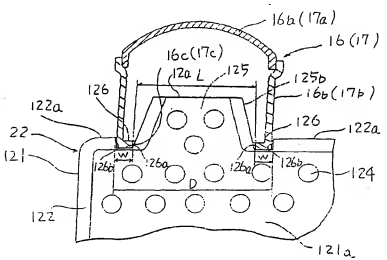
(54) Heat exchanger

(57) A heat exchanger (10) comprises at least one conduit (16,17) which has a plurality of slots (16C,17C) therein. A plurality of tube units (12,22) each has at least one open end (12A,22A) thereof. The open end (12A, 22A) of each the tube units (12,22) is fixedly and hermetically coupled to the slots (16C,17C) of at least one conduit (16,17). The tube units (12,22) in fluid communication with the interior of the conduit (16,17) through the open end (12A,22A) of each tube unit (12,22). A limiting mechanism (126,226) is provided adjacent to the open end (12A,22A) of the tube units (12,22) for limiting the conduit (16,17) to have a predetermined position without inclining related to the tube units (12,22).

Thereby, the heat exchanger (10) could be temporally assembled without any relative sliding motion between the plurality of tubes and tanks while simultaneously non-decreasing the efficiency of manufacturing costs of the heat exchanger.

FIG.7



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changer 10, the entire exterior surface of heat exchanger 10 is spray coated with flux dissolved in water. After this, assembled heat exchanger 10 is transported from an assembly line top furnace in which a brazing process is carried out.

In this arrangement, these parts of the heat exchanger facilitate to be disengaged or to have non-standard configuration because of the relative sliding of parts when the brazing process is complete in the furnace. Then, it should be noted that in pre-assembly, it is important to maintain desirable relative configuration of the parts of the heat exchanger in order to prevent defects of brazing in the assembly process.

Various techniques have been used in the prior art to resolve the problem, in particular, it is known to use a fastening tool which is temporally attached to the temporally assembled condenser so as to firmly fasten the parts each other. The fastening tool is detached from the heart exchanger after completion of the brazing process. However, the steps of attaching the fastening tool to the temporarily assembled heat exchanger and detaching the fastening tool from the brazed the heat exchanger after completion of the brazing process complicates the manufacturing process of the heat exchanger.

Hence, the efficiency of manufacturing the heat exchanger is decreased. Furthermore, the provision of the fastening tool increases the manufacturing costs of the heat exchanger.

Furthermore, tapered portion 125b of tongue 125 is naturally formed as tapered shape in order to be smoothly inserted into slots 16c and 17c of tanks 16 and 17. Thereby, if tapered portion 125b and slots 16c or 17c had undesirable designed size after production process, the insertion of tongue 125 terminate before slots 16c or 17c of tank 16 or 17 dose not reach the root of tongue 125. Therefore, the tapered shape of tongue 125 facilitates to fluctuate the insert margin created between tongue 125 and tanks 16 and 17 or to cause undesirable relative inclination between tube unit 12 and tanks 16 and 17.

One attempt to these problems is disclosed in Unexamined Japanese Patent publication No.SHO-63-19890. This invention discloses the stopper which limits the margin created between end of tube and interior surface of tank when the tube is inserted into the tank. However, the invention dose not resolve the above problem since it dose not have a function of maintaining desirable relative configuration between the tube and the tank.

These and other problems with prior art air conditioning systems are sought to be addressed by the following preferred embodiments.

It is an object of the present invention to provide a simply manufactured heat exchanger having a proper configuration and completely hermetic connections between a plurality of tubes and tanks.

It is another object of the present invention to provide a heat exchanger which can be temporally assembled without any relative sliding motion between the plurality of tubes and tanks while simultaneously non-decreasing the efficiency of manufacturing costs.

According to the present invention, a heat exchanger comprises at least one conduit which has a plurality of slots therein. A plurality of tube units each has at least one open end thereof. The open end of each the tube units is fixedly and hermetically coupled to the slots of at least one conduit. The tube units in fluid communication with the interior of the conduit through the open end of each tube. A limiting device is provided adjacent to the open end of the units for limiting the conduit to have a predetermined position without inclining related to the tube units.

In the accompanying drawings:-

Figure 1 is a perspective view of a heat exchanger, such as an evaporator, in accordance with a prior art.

Figure 2 is an enlarged plane view of a tube unit of the heat exchanger in shown in Figure 1.

Figure 3 is an expanded perspective view of the heat exchanger in Figure 2

Figure 4 is an enlarged cross-sectional view of tank member in accordance with the prior art.

Figure 5 is an enlarged plane view of a tube unit of the heat exchanger in accordance with a first embodiment of a present invention.

Figure 6 is an expanded perspective view of the heat exchanger in accordance with a first embodiment of a present invention.

Figure 7 is an enlarged cross-sectional view of tank member in accordance with the first embodiment of a present invention.

Figure 8 is a schematic view illustrating a refrigerant flow in the heat exchanger in accordance with the first embodiment of a present invention.

Figure 9 is an enlarged cross-sectional view of tank member in accordance with a second embodiment of a present invention.

Figure 10 is an enlarged cross-sectional view of a flat tube in accordance with the second embodiment of a present invention.

Referring to Figure 5 and 6 depicts a tube unit of drain-cup type heat exchanger used for an evaporator of an automotive air conditioning refrigerant circuit in accordance with a first embodiment of the present invention. In the drawings, like reference numerals are used to denote elements corresponding to these shown in Figure 1-4, so that a further explanations thereof is omitted.

Referring to Figure 7, tray-shaped plate 121 includes a pair of cut-out portions 126 formed in upper end portion 122a and at the root of both sides of tongue 125. Each of cut-out portion 126 forms a quadrilateral shape which has downwardly a depth H along taper 125b of tongue 125, and has horizontally a width W. Where each of slits 16c and 17c of lower tank member 16b and 17b has length L, and each of lower tank mem-

22 are fixedly connected to tank 16 or 17, may be connected to header pipe(not shown), and have a plurality of fluid path 225 formed by a plurality of partitions 224. Flat tube 22 is preferably made of an aluminum or aluminum alloy through an extrusion molding process.

In the pre-assembly of the heat exchanger, each flat tubes 22 is inserted into the interior of tank 16 or 17 through each slot 16c or 17c. The insertion of flat tube 22 is terminated when the bottom surface of tank 16 or 17 is contacted with bottom portion of cut-out portion 226 of flat tube 22. The bottom surface of tanks 16 or 17 engages cut-out portion 226 of tubes 22.

Thereby, a pair of cut-out portions 226 functions to prevent tank 16 or 17 from inclining relative to flat tubes 22 according as three inner wall of cut-out portion 226 supports the peripheral portion of slots 16c and 17c of tanks 16 and 17 and the outer surface of lower tank member 16b or 17b.

Substantially, the same advantages are realized in the first and second embodiments, so details of the advantages are not repeated.

Claims

1. A heat exchanger (10) comprising;

   at least one conduit (16, 17) having a plurality of slots (16c, 17c) therein;
   a plurality of tube units (12, 22) each having at least one open end (12a, 22a) thereof, said open end (12a, 22a) of each said tube units (12, 22) fixedly and hermetically coupled to said slots (16c, 17c) of at least one said conduit (16, 17), said tube units (12, 22) in fluid communication with an interior of said conduit (16, 17) through said open end (12a, 22a) of each said tube (12, 22);

   characterized in that limiting means (126, 226) is provided adjacent to said open end (12a, 22a) of said tube units (12, 22) for limiting said conduit (16, 17) to have a predetermined position without inclining related to said tube units (12, 22).

2. The heat exchanger recited in claim 1, wherein said limiting means (126, 226) further limits insertion margin which said tube units (12, 22) has during inserting into an interior of said conduit.

3. The heat exchanger recited in claim 1, wherein said limiting means (126, 226) is a pair of cut-out portions (126, 226) formed on a peripheral of said tube units (12, 22).

4. The heat exchanger recited in claim 1, wherein said conduit (16,17) further comprises a cover member (16a, 17a) and a seat member(16b, 17b) connected to each other to form a tank, and said seat member (l6b, 17b) including a bottom wall, a plurality of equal interval slots (16c, 17c) formed on said bottom wall and a side wall perpendicularly extending from both ends of said bottom wall.

5. The heat exchanger recited in claim 4, wherein a pair of said cut-out portion (126, 226) engages edges of said slot and side walls of said seat member of said conduit (16, 17).

6. The heat exchanger recited in claim 1, wherein said open ends (12a, 22a) of said tube units (12, 22) are brazed to said conduit (16, 17).

7. The heat exchanger recited in claim 1, wherein said heat exchanger (10) further includes a plurality of fin members (13) disposed between adjacent said tube units (12, 22).

8. The heat exchanger recited in claim 1, wherein said heat exchanger (10) includes a pair of conduit (16, 17) interconnected by a plurality of said tube units (12, 22).

9. The heat exchanger recited in claim 1, wherein said tube units (12, 22) is laminated tubes having a main body (221), a pair of flange portion (222) integrally extending from both sides of said main body (221) and open ends (22a) formed on both ends of said mainbody.

10. A heat exchanger comprising:

    a plurality of said tube units (12) each having a pair of plates (121) joined together to define therebetween a fluid passageway and at least one generally tubular opening (12a) projecting upward from a top surface of said plates (121) and linked in fluid communication with said fluid passageway;
    at least one conduit (16, 17) disposed on an upper surface of said a plurality of tube units (12), at least one said conduit (16, 17) including a cover member (16a, 17a) and a seat member (16b, 17b) connected to each other to form a tank, and said seat member (16b, 17b) including a bottom wall, a plurality of equal interval slots (16c, 17c) formed on said bottom wall and a pair of side walls perpendicularly extending from both erids of said bottom wall;

    characterized in that a pair of cut-out portions (126) respectively are formed at both root sides of said tongue (125) of said plate (121) so as to limit said header pipe (16, 17) having a predetermined position without inclining related to said tube units (12, 22) by engaging edges of said slot and said.

FIG. 1
(Prior Art)

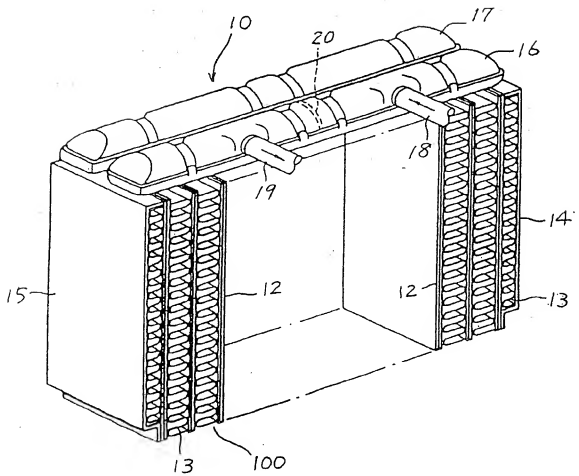

FIG.3
(Prior Art)

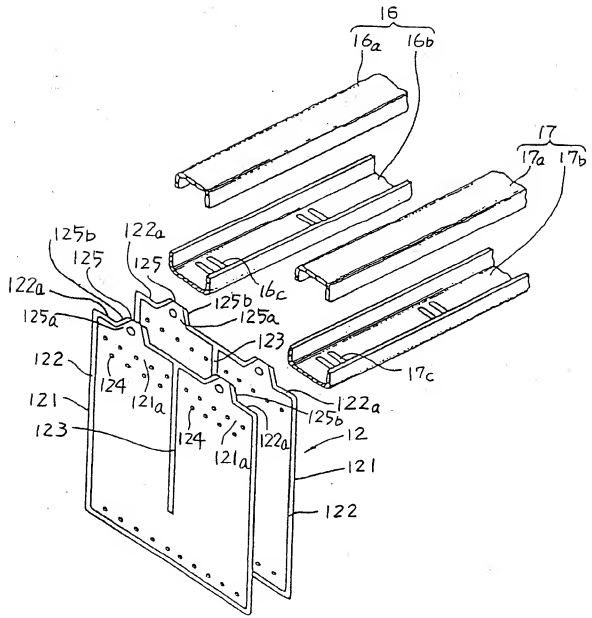

FIG. 5

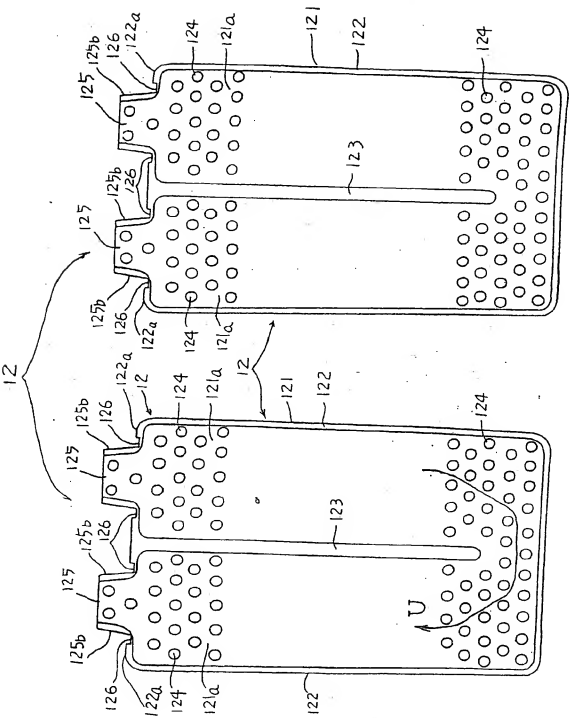

FIG.7

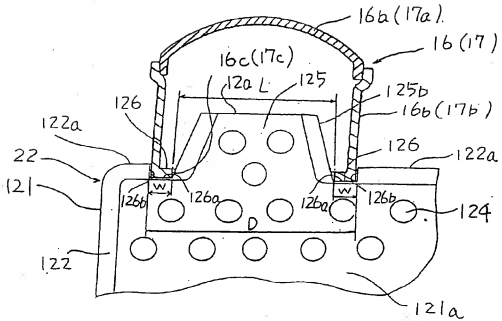

FIG.8